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Sea; where the excessive saltness of the water will now be naturally accounted for, since it is a condensation of that which, having been a part of the ocean, was salt *ab origine*.

The process of evaporation and depression would still continue, till the surface of the Dead Sea should be reduced to such an area as would just balance the water discharged into it; and then, the only changes would be in the oscillations of that balance, caused by extraordinary floods or droughts.

From a fact observed by travellers in three consecutive years, namely, that a salient part of the N. shore is sometimes an island, and sometimes peninsular, there is some reason for conjecturing that the point of equilibrium has been already reached.

This might be ascertained by more careful observations at that locality, or by comparing fresh lines of soundings with those taken by Captain Lynch, U.S.N., in the southern portion of the sea: "The bay that looketh south."

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#### XIV.—*On the Watershed of Wadi el Arabà.* By Captain WILLIAM ALLEN, R.N., F.R.S., F.R.G.S.

Read February 14, 1853.

As the existence of the great depression of the Dead Sea, below the level of the Mediterranean, was unknown till the year 1837, so the fact of the downward slope of Wadi el Arabà, though the necessary consequence of such depression, was overlooked till the Comte de Bertou traversed its whole length in 1838. For so gradual does the inclination appear, that it was generally considered as a plain; and many geographers had even entertained the idea, that the river Jordan anciently discharged itself into the Gulf of Akabà by this valley.

The fallacy of this was first proved by that traveller; but the extent and elevation of the tract of land lying between the northern margin of the Gulf of Akabà and the point, at the same level in Wadi Arabà, where commences the downward slope to the Dead Sea, is a problem that still remains to be solved.

This tract of land contains the ridge that separates the torrents flowing northwards, on one side, to the Dead Sea, and southwards on the other, towards the Gulf of Akabà. It is the "watershed," or waterparting, of the Wadi Arabà.

As the notices that have been given by travellers on this important point of physical geography—though at first sight they appear to be conclusive—are conflicting among themselves, I have thought it desirable to lay them before the Society, in order that we may be able to estimate the amount of knowledge now existing, as far as I can collect, on the subject.

Burckhardt, in 1812, crossed the Wadi Arabà on his road to Egypt from Petra. He says, it is a continuation of the Ghor, which may be said to extend from the sources of the Jordan to the Red Sea. He descended into the valley, near the lateral Wadi Ghurundel, which comes from the eastern mountains of Edom. He calls it a *plain*, presenting a wide expanse of shifting sand, whose surface is broken by innumerable *low hills and undulations*. He left this plain by a gentle ascent of an hour and a half in the lateral Wadi Talh, which discharges itself into el Arabà from the western mountains.

Irby and Mangles, in 1818, saw little of the Ghor, except in crossing the N. end of it. They were told that the *plain* at the top of the cliffs, which bounded their view to the S., continues all the way to Mekka without interruption.

I merely mention these to show that it was considered to be a *plain*. The only specific information on the subject is derived from the journey of the Comte de Bertou, which was undertaken for the express purpose of ascertaining the nature of the Wadi Arabà; and it is a great misfortune to science, that his indefatigable exertions have only led to results depending on his judgment; as his barometer was broken long before he reached the point in question. Nevertheless, he gives it as his conviction, that the separation of the waters is at the embouchure of the Wadi Talh, 55 miles from the Dead Sea, and about 45 miles from the Gulf of Akabà; because—

1st. He says it is impossible to mistake the two slopes N. and S.

2nd. He thought the slope towards the Red Sea must be very rapid, because his horizon was very confined, and cut the cape, at the foot of which the castle of Akabà is situated.

3rd. On the authority of his Arabs, who gave the name of Wadi Akabà to the southern prolongation of the valley.

The opinions of this traveller are entitled to great respect, from the minuteness of his observations, from the care he took to keep in the trough of the valley, and from his evident anxiety to ascertain the truth; but as they are at variance with those of other travellers, it will be well to examine and compare them.

1. With respect to the unmistakable slope N. and S., I find that 4h. 10min. before he had arrived at this point, which he calls the watershed, he suspected the intention of his Arabs to mislead him; he therefore left the direction which they pointed out, to the eastward of S., and, depending on his own judgment and on his compass, he proceeded nearly S.S.W. or  $220^{\circ}$ : and thus in his anxiety to keep in the trough of the Wadi Arabà, it is possible that he may have entered that of Wadi Talh, a lateral valley; and, standing on the right bank of this, the point of separation between the two valleys, would necessarily have seen two

slopes. Now, although the Arabs are believed to have a systematic predilection for lies, they may in this instance have been telling the truth—namely, that the direction of the trough of the Wadi Arabà was more to the eastward than the course taken by the Count. This will hereafter receive confirmation, from an observation made by Dr. Robinson.

2. If I understand the remark about the horizon, at this point, being very confined, I should consider it to be the effect of a rise, rather than of a fall in the ground, since a rapid slope downwards would give an extended horizon.

3. By the name Akabà (ascent), given by the Arabs to the valley S. of the junction with the Talh, was probably meant the ascent of the road to Egypt by this Wadi, which took Burekhardt an hour and a half before he reached the summit of the mountains.

Lastly. De Bertou continuing his journey, at 7 miles from the supposed watershed, came to the lateral Wadi Ghurundel, which, coming from the mountains of Edom, is supposed and asserted by Robinson, on the authority of his Arabs, to discharge its waters northwards into the Dead Sea. Returning from Akabà, De Bertou kept on the *eastern* side of the Wadi Arabà; and at a place called El Sath (the roof), our traveller believes himself to be again at the culminating point, as the hills extend E. and W. It is opposite to Wadi Talh, but the breadth of the valley between these two positions is no less than 14 miles; therefore it is not improbable that at both he was at or near the extreme margin of the valley, which may be presumed to have a considerable depression towards the middle. The range of hills is no proof to the contrary, as the watercourse might lie between them. He gives the elevation of El Sath, above the Mediterranean, as 480 Paris feet; but only by estimation. His results, by the point of boiling water, must be very wide of the truth, as there is a great discrepancy between them at the two stations; and they differ very much from his estimation at El Sath. They do not appear in his paper in our Journal, but it must be remembered that he had only a common thermometer. I therefore submit, that notwithstanding the zeal and exertions of M. de Bertou, his data are not sufficient for determining the position and elevation of the watershed.

Dr. Schubert's barometrical observations have also been taken as determining this important point; but his words are not to that effect, and he makes several pertinent remarks which would lead to an opposite conclusion.

His road near the foot of the eastern mountains began, soon after leaving Akabà, gradually to ascend. The valley widened to about 12 miles, with a rapid slope from the E. towards the W.; and "while along the foot of the eastern heights one travels

on the edge of the valley (auf dem Firsten des Thales),—on its western margin, along the side of the Tyh mountains, one is in a depression, which, in the middle, is very little above the level of the sea, and must, in the rainy season, be overflowed in the greater part.” He says this may account for the prolongation of the Ælanitic Gulf, towards the N., which appears in some of the old maps.

Another important remark of Dr. Schubert is, that the lateral valleys, from both the eastern and the western mountains, converge to the northwards; therefore the course of their united waters in the Wadi Arabà would be in that direction, and the watershed must be to the S. of the first point of convergence. It is true that this cannot be determined by a remark in such general terms, but the presumption is, that it must be far S. of the parallel of Mount Hor, and not far from the head of the gulf, since this is one of the first observations of our traveller after leaving Akabà. Now, the positions El Sath and the mouth of the Wadi Talh are very near the parallel of Mount Hor, which would confine the convergence, towards the N. of the lateral valleys, to the short distance of 55 miles from the Dead Sea; and as its distance from Akabà is 45 miles, if we assume the slope on either side of this ridge to be the same, there would be only 10 miles for the fall of the valley from the level of the gulf to that of the Dead Sea, 1312 feet. This is twice as great as the fall between the lakes Huleh and Tiberias, and does not agree with the accounts of travellers of a slope so gentle that it has the appearance of a plain.

At the distance of one day and a half from Akabà, Schubert's elevation above the sea, by barometric observation, was 465 Paris feet; on the third evening it was 954 feet; and as he does not say anything about the watershed, there is no more reason for taking the first than the second for its height; but the coincidence in position and elevation with De Bertou's hypothesis might have led to its adoption. It appears to me more likely that he had arrived at a high point of the Shera mountains, especially since he says the Arabs had selected this spot for their village of tents, on account of the abundance of pasturage for their flocks in the lateral and adjacent valleys.

Dr. Robinson crossed the Wadi Arabà at two places, but did not go through its whole length. He says the torrents from the Western mountains, when not absorbed by the sand, fall into the Gulf of Akabà, near its N.W. corner. There is no appearance of any other watercourse; but, on the contrary, along the rest of the northern shore the sea has thrown up an unbroken bank of sand and gravel higher than the level of the Wadi, which seems to have little or no acclivity to the N. Towards the Western

mountains a large tract has the appearance of moist marshy ground. The most important information given by this observant traveller, is the description of the Wadi, as seen from the pass of Nemela, a commanding position on the flank of Mount Hor. He says—

“Towards the S., the direction of a small fountain, 'Ain Melihy, was pointed out at the mouth of a short Wadi S. of the Jerâfeh. In the same quarter we could distinctly perceive Wadi el Jeib, (the trough of el Arabà) winding along the middle of el Arabà, from the south, and at length sweeping off N.W., as if to meet the Jerâfeh; and having received this Wadi, it again winds N.E. and afterwards north-westerly, so as to pass El Weibeh at the foot of the Western mountains. Here our guides again assured us, that the waters of the southern Wadi Ghurundel flow northwards through El Jeib; and we had no reason to distrust the accuracy of their information; for the whole appearance of the Arabà, and of the Jeib winding through it so far S. of the Jerâfeh, led naturally to the same conclusion.”

Again he says—

“We had now learned enough of the region, to understand why the Jerâfeh and all the Wadis which drain the Western desert should run towards the North, a fact which at first appeared very singular.”

Now, supposing the Wadis Talh and Jerâfeh to be identical, it is evident that the trough of the Arabà—the Wadi Jeib—has its origin far to the S. of the supposed watershed of De Bertou, and in its north-westerly bend to meet the Jerâfeh or Talh, there is presumptive evidence that his Arabs were right in wishing him to take a course to the S.E., so that by rejecting their advice he left the trough of the Arabà and entered that of el Talh. This will not appear strange, when we consider the difficulty there is in tracing a watercourse in the wide expanse of a sandy desert.

The salt-marsh seen by Rüppell and Robinson strengthens the hint thrown out by Schubert, that it may account for the prolongation of the Ælanitic Gulf in old charts, and would show analogy with the bitter lakes at the head of the Gulf of Suez. Both may have been detached from the Red Sea by the same upheaving; but, in any case, the existence of this salt-marsh is a proof that there is level ground to that distance at least, which must limit the length, as well as the height, of the upheaved tract,—the hypothetical strait that originally joined the basin of the Dead Sea with that of the Gulf of Akabà, to which I alluded in my former paper.

From a consideration of these circumstances, I therefore submit, that the extent and elevation of the watershed of Wadi el Arabà are still unknown. The subject is of great importance, both in itself and in the consequences to which it may lead. I venture to suggest that it behoves Great Britain to solve the problem, since the discovery of the depression of the Dead Sea

was made by two of our countrymen, Messrs. Moore and Beke, and verified by Major Symonds, R.E., and Lieut. Molyneux, R.N.,—followed up by the American government, which sent an expedition at considerable expense across the Atlantic to continue their surveys.

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XV. — *Further Considerations on the Great Isthmus of Central America*. By Capt. ROBERT FITZROY, R.N., &c.

Read March 14th, 1853.

IN November, 1850, a Paper on the American Isthmus was read to the Royal Geographical Society, and was subsequently printed in their Journal, vol. xx., part ii., p. 161.

To that Paper it is proposed that this should be supplementary, because, although additional information has been obtained, nothing has yet appeared to invalidate the contents of that compilation; and it will save time to refer to those briefly, rather than incur the risk of unnecessary repetition.

GEOGRAPHICAL investigations are, in themselves, so very interesting, that their possible importance in a rather unscientific though a practical point of view may be less present to the mind of a lover of truthful information (for its own sake) than to the keen eye of enterprise. But such comparative indifference to consequences may be valuable in examining a much disputed question, as tending to promote impartiality.

Interesting and important to the whole civilised world as the Central Isthmus of America has become during the present century, its interest and its importance have been augmented during the last few years in a manner that seems destined to engage a large share of public attention.

Becoming year by year a greater thoroughfare, more and more frequented by increasing numbers of the migratory and enterprising Anglo-Saxon race, by the carriers of mail-bags and merchandise, and by the bearers of gold, the formidable barrier that so narrow a neck of land still opposes to unbroken and direct commercial intercourse is more and more understood and realised.

Scarcely had Asa Whitney tried to divert attention from Central America to his startling project for traversing a Continent, when Australian gold demanded instant and definite attention to a more rapid and better mode of communicating with Australasia—since when increasing demand for rapid voyages, and continual improvements in shipping, have irresistibly encouraged the desire to cut through the Isthmus. A spirit of enterprise that India, China, Peru, and even California, scarcely stimulated, has been caused